CONTINUOUS FIBER CERAMIC COMPOSITES

Project Fact Sheet

CFCC Hot Gas Candle Filters

Benefits

Industries that use CFCC components in their applications will realize substantial energy, environmental and financial benefits, including higher efficiency, lower maintenance, and decreased operating costs. Benefits will accrue from optimization of process operating conditions, reduced down time, and increased useful life times. CFCC hot gas candle filters provide:

- improved reliability and resistance to thermal shock over monolithic ceramic components
- significantly higher resistance to corrosion than metal filters, allowing operation at higher temperatures

Applications

Hot gas candle filters are porous closed-end tubes that remove fine coal ash particles from pressurized fluidized bed combustion systems and coal gasification systems. Filters can also be used for particulate removal in the chemical and refining industries.

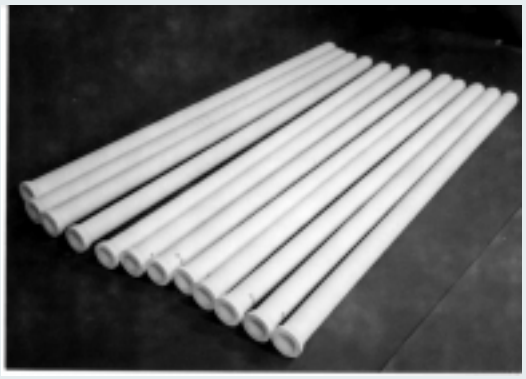
Fiber slurry and sol-gel impregnation process used to fabricate CFCC hot gas candle filters

The U.S. Department of Energy's Office of Industrial Technologies (OIT) initiated the Continuous Fiber Ceramic Composite (CFCC) Program in 1992 as a collaborative effort between industry, National Laboratories, universities and government.

Through support of the CFCC Program, McDermott Technology is developing a fiber slurry and sol-gel impregnation process (a liquid precursor converted to solids) to produce CFCCs. Porous CFCC tubular components are made using a combined filament winding and vacuum forming process. This technique is ideal for oxide-based composite systems and allows scaling for cost-effective manufacturing operations.

McDermott Technology is using this processing technique to fabricate porous hot gas candle filters. Hot gas candle filters remove fine coal ash particles in pressurized fluidized bed combustion systems and coal gasifications systems. Filters also can be used for particulate removal in the chemical and refining industries. CFCC filters are being evaluated for contaminant removal in streams operating at 600 to 1,800^{0} F. Due to their toughness and thermal shock resistance, CFCCs overcome current filter failures, such as the inability to survive back-pressure pulses used for cleaning. CFCC cleaning systems will reduce emissions and costs, increase product yield and efficiency, and protect downstream equipment from wear.

Hot Gas Candle Filters



Individual hot gas filters (left - 1.5 meters long) and filter assembly (right).

Project Description

Goal: The goals of this project are to: 1) develop functional CFCC components using the sol-gel process for hot gas filter applications; 2) demonstrate processing methods suitable for cost-effective manufacturing; and 3) determine the operating parameters of the CFCC materials over the long-term in the application environment.

As exhibited by this project, the CFCC Program is addressing the critical need for advanced materials that are lighter, stronger, and more corrosion-resistant than metals. The Program strives to advance processing methods for reliable and cost-effective ceramic composite materials to a point at which industry assumes the full risk of development and commercialization. The long-term strategy is to develop the primary processing methods for reliable and cost-effective fabrication of CFCCs and to perform application-specific testing which will meet the needs of a wide range of energy saving applications in industry. These industries include: power generation, agriculture, aluminum, steel, chemicals, forest products, glass, metal casting, mining and refining.

Progress and Milestones

- Developed CFCC candle filter tubes that meet the specifications of the application and can be reproduced by the modified filament winding process.
- Tested sub-size tubes at Westinghouse Electric in laboratory apparatus and in a simulated pressurized fluidized bed combustion (PFBC) test facility.
- Fabricated and installed full size CFCC candle filter tubes in a plant in Karhula, Finland. These tubes operated successfully for 580 hours.
- Installed hot gas filters at the Power System Development PFBC facility of Southern Company Services in Wilsonville, Alabama. The filters have successfully accumulated over 1,500 hours exposure.

Project Partners

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Oak Ridge National Laboratory
Oak Ridge, TN

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Orlando, FL

Southern Companies Services
Wilsonville, AL

Virginia Tech
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